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Design and Fabrication of Anti-Tilting Mechanism for Three Wheelers

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ABSTRACT:
The latest emerging technologies for safety of vehicle is focusing on finding new ways/methods for reducing accidents and reducing damage due to vehicle unbalancing during taking curve. Road accidents are increasing day by day and death due to accidents has also been increased. But accidents cannot be reduced due to increasing population and thus increasing vehicles on the road. If the accident does not cause death, it does damage to the driver and other passengers and also to the vehicle. In a study it has been revealed that many accidents occur at horizontal curves. So, we have studied and promoted the use of a concept "chassis balancing". By using modern technology both use of mechanical and mechatronics safety of the vehicles can be enhanced thus ,number of deaths, damage to vehicle or injury human body can be minimized .

I. INTRODUCTION :

Some of the automotive manufacturers already use shock absorption system that consist passive damper located between the bumper and the vehicle chassis. However, while taking curve the system most of the force will be dissipate by transmitting all the impact energy through the compression of the damper and the remaining force will be transferred to the vehicle chassis and pushes the opposite side of the dampers upside thus the chassis lifts at one side during curve , the vehicle during turning following actions are taken place like .

1.Bouncing: The vertical movement of the complete body .

2.Pitching : The rotating movement of all the parts between the spring and road and the portion of spring weight itself.

3. Rolling: The movement about longitudinal axis produced by the centrifugal force during cornering vehicle's total mass that is supported above the suspension. The weight typically includes the body, frame, the internal components, passengers, and cargo but does not include the mass of the components suspended below the suspension components (including the wheels, wheel bearings, brake rotors, calipers)

During turning of the vehicle centrifugal force z at points down and the drag force x applies to lateral force y during taking curve roads, thus intends x longitudinal force rolling of the chassis taken place, this physical action of the vehicle intends to cause accident and thus to prevent those incidents mechanical and modern electronically controlled systems in automobiles almost always feature self-leveling along with raising and lowering functions of the chassis by use of activated dampers fitted under the chassis.by doing this rolling can be avoided and stability can be maintained.

Need of system:

1. For absorbing shocks and vibration caused due to road irregularities.
2. For transmitting vehicle load to the wheels (Supporting the weight)
3. For maintaining the stability of vehicle (contact of the wheels to ground)
4. For providing cushioning and ride comfort to the passengers
5. For preventing body squat and body dive.

COMPONENTS

BEARING WITH BEARING CAP

The bearings are pressed smoothly to fit into the shafts because if hammered the bearing may develop cracks. Bearing is made upon steel material and bearing cap is mild steel.

Ball and roller bearings are used widely in instruments and machines in order to minimizefriction and power loss. While the concept of the ball bearing dates back at least to Leonardo daVinci, their design and manufacture

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has become remarkably sophisticated.This technology was brought to its p resent state o f perfection only after a long period of research and development. The benefits of such specialized research can be obtained when it is possible to use a standardized bearing of the proper size and type. However, such bearings cannot be used indiscriminately without a careful study of the loads and operating conditions. In addition, the bearing must be provided with adequate mounting, lubrication and sealing. Design engineers have usually two possible sources for obtaining information which they canuse to select a bearing for their particular application:

For this reason, we are interested in providing a condensed overview of the subject matter in an objective manner, using data obtained from different texts, handbooks and manufacturers' literature. This information will enable the reader to select the proper bearing in an expeditious manner. If the designer's interest exceeds the scope of the presented material, a list of references is provided at the end of the Technical Section. At the same time, we are expressing our thanks and are providing credit to the sources whichsupplied the material presented here.

Construction and Types of Ball Bearings

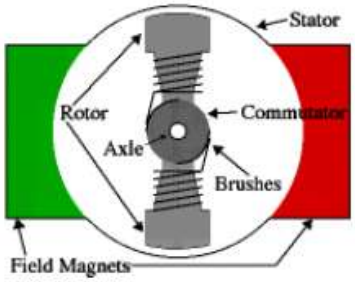
A ball bearing usually consists of four parts: an inner ring, an outer ring, the balls and the cage or separator. To increase the contact area and permit larger loads to be carried, the balls run in curvilinear grooves in the rings. The radius of the groove is slightly larger than the radius of the ball, and a very slight amount of radial play must be provided. The bearing is thus permitted to adjust itself to small amounts of angular misalignment between the assembled shaft and mounting. The separator keeps the balls evenly spaced and prevents them from touching each other on the sides where their relative velocities are the greatest. Ball bearings are made in a wide variety of types and sizes. Single-row radial bearings are made in four series, extra light, light, medium, and heavy, for each bore.

DC MOTOR

A DC motor is a mechanically commutated electric motor powered from direct current (DC). The stator is stationary in space by definition and therefore so is its current. The current in the rotor is switched by the commutator to also be stationary in space. This is how the relative angle between the stator and rotor magnetic flux is maintained near 90 degrees, which generates the maximum torque. DC motors have a rotating armature winding but non-rotating armature magnetic field and a static field winding or permanent magnet. Different connections of the field and armature winding provide different inherent speed/torque regulation characteristics. The speed of a DC motor can be controlled by changing the voltage applied to the armature or by changing the field current. The introduction of variable resistance in the armature circuit or field circuit allowed speed control. Modern DC motors are often controlled by power electronics systems called DC drives. The introduction of DC motors to run machinery eliminated the need for local steam or internal combustion engines, and line shaft drive systems. DC motors can operate directly from rechargeable batteries, providing the motive power for the first electric vehicles. Today DC motors are still found in applications as small as toys and disk drives, or in large sizes to operate steel rolling mills and paper machines.

Principles of Operation of DC Motor:

In any electric motor, operation is based on simple electromagnetism. A current-carrying conductor generates a magnetic field; when this is then placed in an external magnetic field, it will experience a force proportional to the current in the conductor, and to the strength of the external magnetic field. As you are well aware of from playing with magnets as a kid, opposite (North and South) polarities attract, while like polarities (North and North, South and South) repel. The internal configuration of a DC motor is designed to harness the magnetic interaction between a current-carrying conductor and an external magnetic field to generate rotational motion.Let's start by looking at a simple 2-pole DC electric motor (here red represents a magnet or winding with a "North" polarization, while green represents a magnet or winding with a "South" polarization).



Every DC motor has six basic parts -- axle, rotor (a.k.a., armature), stator, commutator, field magnet(s), and brushes. In most common DC motors (and all that BEAMers will see), the

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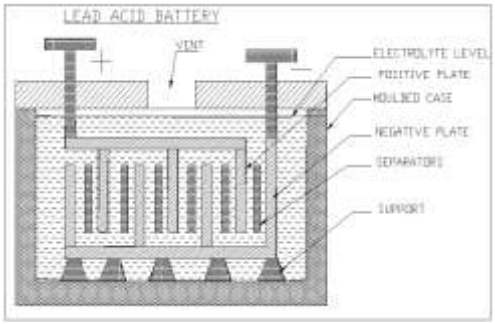
external magnetic field is produced by high-strength permanent magnets1 . The stator is the stationary part of the motor -- this includes the motor casing, as well as two or more permanent magnet pole pieces. The rotors (together with the axle and attached commutator) rotate with respect to the stator. The rotor consists of windings (generally on a core), the windings being electrically connected to the commutator. The above diagram shows a common motor layout -- with the rotor inside the stator (field) magnets. The DC Motors operate at 12 Volts and have the specification of 60 rotations per minute. In our project they are responsible for the movement of the Agribot and to perform harvesting and seed dropping.

Specifications of 180W **wiper motor**:
Power:180W, 24V & **12V**
Stall totque: 100N.m
Low speed:25+/-5rpm
high speed:35+/-5rpm...

LEAD-ACID WET CELL:

Where high values of load current are necessary, the lead-acid cell is the type most commonly used. The electrolyte is a dilute solution of sulfuric acid (H_2SO_4). In the application of battery power to start the engine in an auto mobile, for example, the load current to the starter motor is typically 200 to 400A. One cell has a nominal output of 2.1V, but lead-acid cells are often used in a series combination of three for a 6-V battery and six for a 12-V battery.

The lead acid cell type is a secondary cell or storage cell, which can be recharged. The charge and discharge cycle can be repeated many times to restore the output voltage, as long as the cell is in good physical condition. However, heat with excessive charge and discharge currents shortends the useful life to about 3 to 5 years for an automobile battery. Of the different types of secondary cells, the lead-acid type has the highest output voltage, which allows fewer cells for a specified battery voltage.



ARDUINO

Arduino UNO has USB interface. The chip on the board plugs straight into your USB port and registers on your computer as a virtual serial port. This allows you to interface with it as through it were a serial device. The benefit of this setup is that serial communication is an extremely easy (and time-tested) protocol, and USB makes connecting it to modern computers really convenient.

Very convenient power management and built-in voltage regulation. It is possible to connect an external power source of up to 12v and it will regulate it to both 5v and 3.3v. It also can be powered directly off of a USB port without any external power. It has countless number of nice hardware features like timers, PWM pins, external and internal interrupts, and multiple sleep modes. A 16 MHz clock. This makes it not the speediest microcontroller around, but fast enough for most

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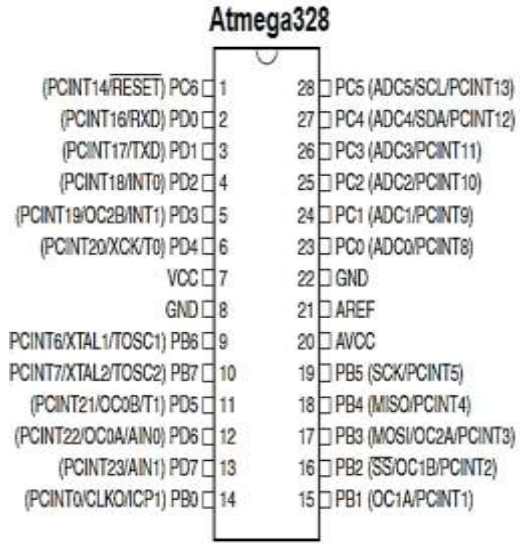
applications.32 KB of flash memory for storing your code. 13digital pins and 6 analog pins.

These pins allow the user to connect external hardware to the Microcontroller. These pins are key for extending the computing capability of the Microcontroller into the real world. Simply plug the devices and sensors into the sockets that correspond to each of these pins.



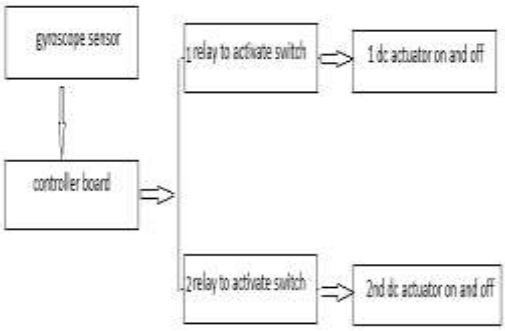
The high-performance, low-power Atmel 8-bit AVR RISC-based microcontroller combines 16KB ISP flash memory, 1KB SRAM, 512B EEPROM, an 8-channel/10-bit A/D converter (TQFP and QFN/MLF), and debug WIRE for on-chip debugging. The device supports a throughput of 20 MIPS at 20 MHz and operates between 2.7-5.5 volts. By executing powerful instructions in a single clock cycle, the device achieves throughputs approaching 1 MIPS per MHz, balancing power consumption and processing speed.

Relay

In figure 3, shows are a relay is an electrically operated switch. Several relays use a magnet to automatically operate a switch, however alternative in operation principles are used, like solid state relays. Relays are used wherever it's necessary to regulate a circuit by a separate low-power signal, or wherever many circuits should be controlled by one signal. The essential relays were handling in long distance communicate circuits as amplifiers, they unbroken the signal coming back in from one circuit and re-transmitted it on another circuit.

WORKING

Depending upon operating conditions and can have knowledge other than the strut deflection the passive system is limited to



Gyroscope sensor fitted front wheel handle which is connected to arduino ,when the handle rotates right or left, the signals in the form of frequency from gyroscope sends to the controller board arduino which is coding to activate the dc actuator

At condition 1, when vehicle turns right,the signals from gyroscope passes to controller and on the relay switch 1 to activate the opposite side (ie., left) of the dc actuator upward thus the chassis lift till the vehicles handle is in straight path

At condition 2, when vehicle turns left,the signals from gyroscope passes to controller and on the relay switch 2 to activate the opposite side(ie., right) of the dc actuator upward thus the chassis lift till the vehicles handle is in straight path

CALCULATIONS

In a levelled circular road, skidding mainly depends on the coefficient of static friction μs The coefficient of static friction depends on the nature of the surface which has a maximum limiting value. To avoid this problem,

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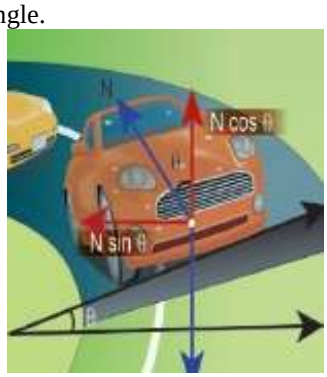
usually the outer edge of the road is slightly raised compared to inner edge as shown in the Figure 3.44. This is called banking of roads or tracks. This introduces an inclination, and the angle is called banking angle.



Let the surface of the road make angle θ with horizontal surface. Then the normal force makes the same angle θ with the vertical. When the car takes a turn, there are two forces acting on the car:
a. Gravitational force mg (downwards)
b. Normal force N (perpendicular to surface)

We can resolve the normal force into two components. N cosθ and N sinθ as shown in Figure 3.46. The component N cosθ balances the downward gravitational force 'mg' and component N sinθ will provide the necessary centripetal acceleration. By using Newton second law

$$N\cos\theta = mg$$

$$N\sin\theta = \frac{mv^2}{r}$$

By dividing the equations we get $\tan\theta = \frac{v^2}{rg}$

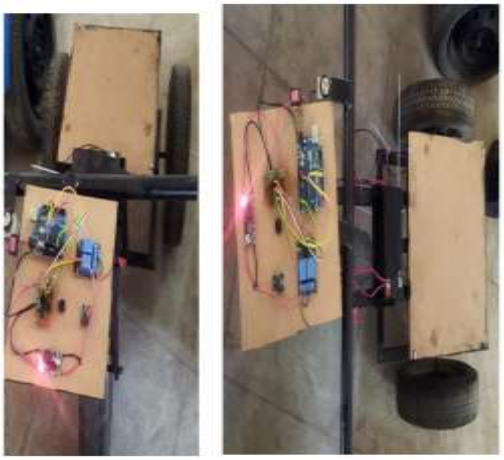
$$v = \sqrt{rg\tan\theta}$$

Considering a circular road of radius 20 meter banked at an angle of 15 degree. With 7.1m/s speed a vehicle has to move on the turn so that it will have safe turn.

$$v = \sqrt{(rg\tan\theta)} = \sqrt{20\times9.8\times\tan15^\circ}$$

$$= \sqrt{20\times9.8\times0.26} = 7.1\ \text{m/s}$$

The safe speed for the car on this road is 7.1 m s-1



ADVANTAGES
1. It will give better comfort to the passengers.
2. It reduces rate of accidents due to skidding.
3. The vehicle will be useful on highways as well as on off roads.
4. Good directional as well as dynamic stability.
5. Load carrying capacity increases.Since the project is based on the Micro controller, it is compact and swift and response.

DISADVANTAGE
1. Whole weight of the vehicle increases.
2. Fuel consumption increases.
3. Weight shifting while turning is required.

APPLICATIONS
1. It may be used in rainy seasons
2. Suitable for handicapped people
3. It can be implemented in four wheeler and also three wheeler

II. CONCLUSION

This project is adopted to use standard and presently used components in design rather than to design all components from ground up. The advantage of this method is that, you do not have to spend ridiculous amount and time in testing the integrity of each part as they have already proved their worth in real world applications. Initially the frame design was adopted from an already existing

narrow car and minor changes were made to suite our purpose.

After designing the tilting mechanism, we have selected the material as per specifications. Two links are flexible or adjustable whereas other two are fixed. Two flexible shock absorbers are connected between the chassis and flexible links. When the vehicle goes across road irregularities, the adjustable linkages will automatically adjust the distance between two wheels and the shocks will not transmit to the vehicle body. It has another function that while negotiating the dead turns, only the wheels will tilt and the body will remain stable.

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